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MAR 12 2018

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Texas Department of Transportation
Environmental Affairs Division
125 East 11th Street
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Dear Mrs. Bechtel:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion (BO) (02ETAU00-2018-F-0244), which is based on our review of the Texas Department of Transportation's (TXDOT) proposed construction of an arterial connector from Ranch to Market Road (RM) 2222 to RM 620 and other improvements to RM 2222, Travis County, Texas (proposed action), and its effects on federally listed threatened and endangered species. In this document we evaluate the effects of the proposed action on: (1) the six endangered karst invertebrates including four arachnids, the Bee Creek Cave harvestman (*Texella reddelli*), Bone Cave harvestman (*Texella reyesi*), Tooth Cave pseudoscorpion (*Tartarocreagris texana*), and Tooth Cave spider (*Tayshaneta myopica*), and two insects, the Kretschmarr Cave mold beetle (*Texamaurops reddelli*) and Tooth Cave ground beetle (*Rhadine persephone*); (2) the Jollyville Plateau salamander (*Eurycea tonkawae*, JPS) and its designated critical habitat; and (3) two federally listed endangered songbirds, the black-capped vireo (BCVI) (*Vireo atricapilla*) and golden-cheeked warbler (*Setophaga [=Dendroica] chrysoparia*, GCWA), pursuant to section 7 of the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 et seq.). We received TXDOT's Biological Assessment (BA) and request for formal consultation on August 23, 2017.

Section 7 of the Act requires that all Federal agencies consult with the Service to ensure that the actions authorized, funded, or carried out by such agencies do not jeopardize the continued existence of any threatened or endangered species or adversely modify or destroy designated critical habitat of such species. As per the Memorandum of Understanding dated December 16, 2014 (23 U.S.C. 327), the Federal Highway Administration (FHWA) assigned responsibility for compliance with the National Environmental Policy Act (NEPA) and all federal resource agency consultations, including section 7 consultations, to TXDOT. Therefore, TXDOT is the federal agency associated with this proposed project.

This BO is based on information provided in TXDOT's August 23, 2017, formal consultation request and BA, information in previous versions of the proposed project, field biological investigation reports, interagency meetings and discussions, Service files, and other sources of information. A complete administrative record of this consultation is on file in the Austin Ecological Services Field Office (AUESFO).



TXDOT has determined this project “may affect, and is likely to adversely affect” *Texella reddelli*, *Texella reyesi*, *Tartarocreagris texana*, *Tayshaneta myopica*, *Texamaurops reddelli*, *Rhadine persephone*, *Vireo atricapilla*, and *Setophaga chrysoparia*. Furthermore, TXDOT has determined the proposed action “may affect, but is not likely to adversely affect” *Eurycea tonkawae*, or destroy or adversely modify its designated critical habitat. We concur with TXDOT’s determination that the project may affect, but is not likely to adversely affect the *Eurycea tonkawae*. The action area of the project is upstream of occupied springs and critical habitat units within the Bull Creek watershed. Water quality impacts could affect salamanders and their springs. To minimize water quality effects, TXDOT proposes to use water quality best management practices that are expected to limit the likelihood that water quality will be degraded by the proposed action at surface or subsurface Jollyville Plateau salamander habitat. Estimates of total suspended sediments expected to enter the Bull Creek watershed from the proposed action are expected to be less than current levels (KCI Drainage Analysis Memorandum dated February 16, 2017).

Consultation History

June, 2017	Site visit and project overview meeting
August 23, 2017	TXDOT submits the Biological Assessment
October 30, 2017	Meeting with Austin Ecological Services Field Office
December 12, 2017	TXDOT extends FAST-41 website deadline for completion of the consultation from January 3, 2017 to February 28, 2018.
December 28, 2017	Service receives a revised project description, revised action area, and contingency procedures for encountering karst features.
January 3, 2018	TXDOT provides revised figures showing the extension of the action area
January 7, 2018	TXDOT provides a revised action area via electronic mail.
January 11, 2018	Meeting of representatives from TXDOT, the Balcones Canyonlands Conservation Plan and the Service on conservation actions
February 13, 2018	Second meeting of representatives from TXDOT, the Balcones Canyonlands Conservation Plan and the Service on conservation actions
February 16, 2018	TXDOT provides revised proposed action
February 22, 2017	The Service provides TXDOT draft BO for review
March 9, 2018	TXDOT provides comments on the draft BO and a new figure of the action area, figure 1.1 (attached)

Document Outline

- I. Proposed Action
- II. Status of the Species and Critical Habitat
- III. Environmental Baseline
- IV. Effects of the Action
- V. Cumulative Effects
- VI. Conclusions
- VII. Incidental Take Statement

BIOLOGICAL OPINION

This transmits the Service's draft biological opinion for TXDOT under Section 7(a)(4) of the Act and as per the Memorandum of Understanding (23 U.S.C. 327) dated December 16, 2014, for the proposed RM 2222 at RM 620 New Arterial Connector (bypass).

I. Description of Proposed Action

As defined in the ESA Section 7 regulations (50 CFR 402.02), "action" means "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the United States or upon the high seas." The "action area" is defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action."

The following is a summary of the proposed action. A detailed description can be found in TXDOT's August 18, 2017, Biological Assessment of New Arterial Connecting RM 2222 to RM 620 and Improvements to RM 2222 and RM 620, Travis County, Texas (BA) with revisions made and transmitted electronically by TXDOT to the Service.

Briefly the BA describes the following projects:

1. Constructing a new four lane connector (bypass) between RM 2222 and RM 620.
2. Creating a new northbound lane on RM 620 to the new bypass by restriping the existing roadway and adding two feet of pavement width.
3. Improving the intersection at RM 2222 and RM 620 with pavement markings and signal timing. TXDOT will install buried conduit for electrical service for transportation signage along RM 620 and RM 2222.
4. Improving RM 2222 from the intersection of RM 2222 and RM 620 to Ribelin Ranch Drive by widening the road from two lanes to three lanes, adding turn lanes, curbed medians, sidewalks, bicycle lanes, storm sewer, and installing a duct bank to bury electrical conduit. TXDOT will relocate existing utilities along RM 2222 in the action area.

Of these projects only those that involve new construction, excavation, or changes to drainage patterns have the potential to affect federally listed species. Road striping, pavement markings, signal timing, new turn lanes, curbed medians and the like, are modifications to existing road

surface and will not affect listed species or their habitats. Therefore, this biological opinion will consider those project elements that have the potential to affect listed species.

Bypass Project

The new bypass is a 0.4 mile long road that will connect RM 620 to RM 2222. Permeable Friction Course (PFC) will be used on the road surface. Road runoff will be channeled to laydown curbs, roadside ditches, and to vegetative filter strips. Sheet flow from up gradient of the bypass will be directed via roadside ditches north of the road to three cross drainage structures that will direct the flow toward Panther Hollow, a watershed that does not support listed salamanders. Two of these would span existing karst features to allow them to remain open and maintain natural drainage to them. An overhead sign would be installed which would require drilling a foundation shaft 24 inches in diameter and approximately 20 feet deep.

RM 2222 Improvements

RM 2222 will be widened from 80-120 feet to 145-160 feet from the bypass to Ribelin Ranch Drive. The section of RM 2222 from the bypass to the intersection with RM 620 will be reconstructed. TXDOT will surface all of RM 2222 in the project area with PFC. Drainage features along RM 2222 will include storm sewer pipes, curbs and drainage inlets, and 7 drainage outfalls. Approximately 425 feet west of the RM 620 and RM 2222 intersection and south of Bullick Hollow Road an area of approximately 10,400 square feet will be graded and stone riprap or gabions will be installed for erosion protection for drainage into Bullick Hollow. Existing buried utility lines will be relocated and installed adjacent to the road requiring trenching.

RM 620 Improvements

RM 620 will be widened by two feet from Comanche Trail for 2,100 feet northward. Buried electrical conduit will be added and will require a trench 1.5 feet wide and 4.5 feet deep from Comanche Trail to approximately 1,000 feet north of the intersection with RM 2222. An existing drainage ditch within the widened road will require regrading.

Conservation Measures

TXDOT is including as part of the proposed action the use of water quality Best Management Practices (BMPs) during construction and for the ongoing operation and maintenance of the road project. These measures include: vegetative filter strips, PFC, maintaining existing surface flows to the extent practicable, and other stormwater control measures along the new bypass and RM 2222. As an additional conservation measure, TXDOT will contribute to the Balcones Canyonlands Conservation Plan (BCCP) in the amount of \$190,655 to support the conservation of federally listed karst invertebrate species, the golden-cheeked warbler, and the black-capped vireo. In addition, TXDOT will provide up to \$200,000 to the BCCP to fund studies and contribute to the restoration of BCP-managed caves. Combined, these measures are intended to minimize impacts to listed species, including the Jollyville Plateau salamander. The BA contains detailed information on the use of the BMPs and their effectiveness to limit water quality impacts from stormwater runoff. Following construction of the proposed action TXDOT will revegetate disturbed areas using native seeds and plants.

While TXDOT was allowed access initially to complete a surface karst feature assessment, access was withdrawn prior to in-cave surveys. Therefore, once TXDOT is granted access to the property and prior to construction, they will assess features in the bypass right-of-way for habitat

suitability and occupancy by listed species. Specific measures and contingency plans are included (email to Service on December 28, 2017) in the project to minimize the impacts to karst invertebrates and the karst environment.

TXDOT provided the Service with additional information on how it will attempt to protect and minimize impacts on some of the karst features that are known to be present and how it will respond if new features are found during construction. These measures include protecting features from construction runoff, evaluating features for karst invertebrate habitat, and attempting to maintain connectivity within the karst ecosystem. The proposed project will require closing karst features. Where it is necessary to close features and voids that have habitat or are occupied by listed species, TXDOT will consult with and follow the closure recommendations of a Service-permitted karst biologist.

Action Area

The “action area” is defined as “all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action”. The Service has determined the action area for this project is the project area as described in the BA and 500 feet outward from the project to capture disturbance effects including potential changes to water quality and flow. Figure 1-5 of the BA as revised and submitted to the Service on January 7, 2018, depicts the action area. The action area is 558 acres as submitted to the Service on January 3, 2018. Figure 1-1 depicts the action area. The project area defined as approximately 83.5 acres of existing and proposed TXDOT right-of-way and easements that are the footprint of the proposed action within the action area.

II. Status of the Species and Critical Habitat

Per the ESA Section 7 regulations (50 CFR 402.14(g)(2)), it is the Service’s responsibility to “evaluate the current status of the listed species or critical habitat.” Critical habitat has not been designated for the endangered karst invertebrate species, the golden-cheeked warbler, or the black-capped vireo.

To assess the current status of the species, it is helpful to understand the species’ conservation needs which are generally described in terms of reproduction, numbers, and distribution (RND). The Service frequently characterizes RND for a given species via the conservation principles of resiliency (ability of species/populations to withstand stochastic events – numbers, growth rates), redundancy (ability of a species to withstand catastrophic events – number of populations and their distribution), and representation (variation/ability of a species to adapt to changing conditions).

Endangered Karst Invertebrates

This biological opinion considers the effects of the proposed action on six endangered karst invertebrates. Five of these species were federally listed in 1988 (53 FR 36029): Bee Creek Cave harvestman, Tooth Cave pseudoscorpion, Tooth Cave spider, Kretschmarr Cave mold beetle, and Tooth Cave ground beetle. The Bone Cave harvestman was listed in 1993 after a taxonomic split from the Bee Creek Cave harvestman (56 FR 43818). No critical habitat was designated for these species.

These invertebrate species share life history characteristics and have morphological adaptations related to living underground during their entire lifespans (troglobitic). Their habitat includes caves and mesocavernous voids in karst limestone (landforms and subsurface features such as sinkholes and caves produced by the dissolution of limestone bedrock). Resilient populations depend on high humidity, stable temperatures, suitable substrate (for example, spaces between and underneath rock), and surface-derived nutrients. Examples of nutrient sources include leaf litter, animal feces, and animal carcasses. The subterranean ecosystem in which these species exist is depends on the overlying surface habitat.

In some cases, the most important source of nutrients for a troglobitic karst invertebrate may be the fungus or microbes that grow on the leaves or troglophile (organisms whose life cycle occurs both within and outside of the cave) feces rather than the original material itself (Elliott 1994). Tree roots can penetrate into caves and may also provide direct nutrient input to shallow caves. In deeper cave reaches, nutrients enter through water containing dissolved organic matter percolating vertically through karst fissures and solution features (Howarth 1983, Holsinger 1988, Elliott and Reddell 1989, Gounot 1994). For predatory troglobites, accidental species of invertebrates (those that wander in or are trapped in a cave) may be an important nutrient source in addition to other troglobites and troglophiles found in the cave (Service 2011).

The cave cricket (*Ceuthophilus* sp.) is a particularly important nutrient component (Barr 1968) and is found in most caves in Texas (Reddell 1966). As a troglophile, cave crickets forage on the surface at night and are generally known to return to the cave during the day where they lay eggs and roost. Cave cricket foraging area is considered to be an area within 105 meters of the cave footprint (Taylor et al. 2005). A variety of troglobites are known to feed on cave cricket eggs (Mitchell 1971), feces (Barr 1968, Poulson et al. 1995), and/or on the adults and nymphs directly (Elliott 1994).

The Service's 1994 recovery plan for the endangered karst invertebrates in Travis and Williamson Counties lists the criteria for changing the status of each of these endangered species to threatened status. The criteria are: (1) three karst fauna areas (KFA), if at least three exist within each karst fauna region (KFR) in each species' range and are protected in perpetuity. (2) Criterion 1 has been maintained for at least five consecutive years with assurances that these areas will remain protected in perpetuity. There are seven KFRs in Travis and Williamson counties that are known to contain listed karst invertebrates species. These regions are delineated based on geologic continuity, hydrology, and the distribution of rare species. Within each KFR, established karst preserves may be considered a KFA if they support one or more locations that is separated from other KFAs such that there are barriers to the movement of water, contaminants, and troglobitic fauna. A KFA must be sufficiently large to maintain the integrity of the karst ecosystem on which the species depends. Therefore, the Service (2012) defined medium and high quality preserves for use in determining the eligibility of a preserve to be considered a KFA. In addition, KFAs must also provide protection from threats such as red-imported fire ants, habitat destruction, and contaminants (Service 2012).

For a more detailed account of the species' descriptions, life history, population dynamics, threats, and conservation needs, refer to the karst invertebrate recovery plan (Service 1994), karst preserve design recommendations (Service 2012), and the several 5-year reviews completed for many of the covered species (Service 2008, 2009a, and 2009b).

In 1988 and 1993 when the Service listed the karst invertebrates in Travis and Williamson counties, and subsequently prepared the recovery plan in 1994, the species were considered rarer than they are today. Benefits that have accrued to these species by the original listing actions include a more focused local and scientific interest in the species such that many additional caves in Travis and Williamson County have been found. For example, in 1963, the Texas Speleological Survey reported only 68 caves in The Caves of Williamson County (Reddell and Finch 1963). The number of known caves in the area today is 203. Thus, many more caves supporting the listed species are known now than were known nearly two decades ago, and a significant number of these sites are under protective management.

Not only are many more occupied caves known today than at the time of the species listings, but several more caves occupied by the listed species are now protected and under some type of conservation management. Numerous occupied caves and cave systems have been avoided and set aside in conservation areas of various sizes, some of which have conservation area boundaries that are very small (1-10 acres; 0.4-4.0 hectares) and likely do not meet the definition of a KFA. Other existing conservation areas are, however, of sufficient size that they either currently meet the KFA general guidelines or could meet those guidelines if enlarged or otherwise enhanced.

Bee Creek Cave Harvestman (*Texella reddelli*)

In 1988, the Service federally listed Bee Creek harvestman (53 FR 36029), since it was known from only five caves throughout its range. Due to increased interest and greater intensity of biotic investigations in caves, by 1993, this species had been split into two species, *T. reddelli* and *T. reyesi* (Bone Cave harvestman). Subsequently, the Service recognized the split and listed Bone Cave harvestman as endangered in 1993 (56 FR 43818).

The endangered Bee Creek Cave harvestman is known from the Jollyville Plateau and Rollingwood KFRs. According to Service GIS files, it has been found in seven caves in Travis County. Within the Jollyville Plateau KFR two caves are owned and managed by the City of Austin and Travis County as part of the Balcones Canyonlands Preserve, are receiving some protection, and could likely be considered medium or high quality KFAs with some additional protections and management. One cave within this KFR is considered destroyed, due to its location in the backyard of a developed neighborhood. Within the Rollingwood KFR two caves are owned and managed by the City of Austin and Travis County as part of the Balcones Canyonlands Preserve, are receiving some protection, and could likely be considered medium or high quality KFAs with some additional protections and management. Two other caves are considered destroyed or significantly impaired, since they are located in back yards of developed neighborhoods.

Bone Cave Harvestman (*Texella reyesi*)

According to Service GIS files, the Bone Cave harvestman is known from six KFRs in at least 203 caves, most of which are in Williamson County. There is potential for this species to meet recovery, as proposed in the recovery plan, within the North Williamson County, Georgetown, McNeil/Round Rock, and Jollyville Plateau KFRs. There are no known potential sites for this species to be adequately preserved in the Cedar Park or Central Austin KFRs.

Tooth Cave Pseudoscorpion (*Tartarocreagris texana*)

The endangered Tooth Cave pseudoscorpion is known from the Jollyville Plateau KFR. According to Service GIS files, all four are owned and managed by the City of Austin and Travis County as part of the Balcones Canyonlands Preserve. Three are within preserves being managed for listed species and could be considered medium or high quality KFAs if they received additional protections and management. However, one is considered impaired due to its location within a developed subdivision.

Tooth Cave Spider (*Tayshaneta myopica*)

The endangered Tooth Cave spider is found in the Jollyville Plateau and McNeil/Round Rock KFRs. According to Service GIS files, nine locations in the Jollyville Plateau KFR are owned and managed by the City of Austin and Travis County as part of the Balcones Canyonlands Preserve. Seven of these have the potential to be considered medium or high quality KFAs if they received additional protections and management. One is within the back yard of a neighborhood and is considered impaired. The ninth location within the Jollyville KFR is privately owned and would likely not meet a KFA quality preserve. There are two caves in the McNeil/Round Rock KFR. One is considered impaired, since it is in the courtyard of a school. The other one is on private land, but could be considered a medium or high quality KFA if protected and managed.

Kretschmarr Cave Mold Beetle (*Texamaurops reddelli*)

The endangered Kretschmarr Cave mold beetle is known from eight locations within the Jollyville Plateau and Rollingwood KFRs. According to Service GIS files, three locations in the Jollyville Plateau KFR are owned and managed by the City of Austin and Travis County as part of the Balcones Canyonlands Preserve. Two of these caves have the potential to be considered medium or high quality KFAs if they received additional protections and management; however, one is within the back yard of a neighborhood and is considered impaired. The remaining five caves are within the Rollingwood KFR. Four caves are owned and managed by the City of Austin and Travis County as part of the Balcones Canyonlands Preserve. Three of these could be considered medium or high quality KFAs if they received additional protections and management and one is considered impaired, due to its location within a subdivision. The final cave is privately owned and is also considered impaired due to its location within a subdivision.

Tooth Cave Ground Beetle (*Rhadine persephone*)

The endangered Tooth Cave ground beetle is known from the Cedar Park and Jollyville Plateau KFRs. According to Service GIS files, there are 36 caves in the Cedar Park KFR. Nine caves (eight privately owned, one State owned) are considered impaired. Twenty-two caves are with the Buttercup Creek Subdivision (PRT 836384) and are considered protected but only one may meet a medium or high quality KFA due to preserve configurations. Five other caves (three owned by the City of Austin, one privately owned, and one owned by the State) may meet medium or high quality KFAs with additional protections and management. There are 18 caves in the Jollyville Plateau KFR. Ten caves are owned and managed by the City of Austin and Travis County as part of the Balcones Canyonlands Preserve. However, only eight of them have the potential to meet medium or high quality KFAs. Eight caves are privately owned, four of these have been impaired, but the remaining four have the potential to meet medium or high quality KFA status.

Golden-cheeked Warbler (*Dendroica [Setophaga] chrysoparia*)

Species Description and Life History

The golden-cheeked warbler was emergency listed as endangered on May 4, 1990 (55 FR 18844). The final rule listing the species was published on December 27, 1990 (55 FR 53160). No critical habitat is designated for this species.

The golden-cheeked warbler is a small, insectivorous songbird (Pulich 1965 and 1976, Oberholser 1974). Golden-cheeked warblers breed exclusively in the mixed Ashe juniper/deciduous woodlands in central Texas west and north of the Balcones Fault (Pulich 1976). Golden-cheeked warblers require the shredding bark produced by mature Ashe junipers for nest material. Typical deciduous woody species include Texas oak (*Quercus buckleyi*), Lacey oak (*Q. glaucoides*), live oak (*Q. fusiformis*), Texas ash (*Frazinus texensis*), cedar elm (*Ulmus crassifolia*), hackberry (*Celtis occidentalis*), bigtooth maple (*Acer grandidentatum*), sycamore (*Platanus occidentalis*), Arizona walnut (*Juglans major*), and pecan (*Carya illinoensis*) (Pulich 1976, Ladd 1985, Wahl et al. 1990). Breeding and nesting GCWA feed primarily on insects, spiders, and other arthropods found in Ashe junipers and associated deciduous tree species (Pulich 1976).

Male GCWA arrive in central Texas around March 1st and begin to establish breeding territories, which they defend against other males by singing from visible perches within their territories. Females arrive a few days later, but are more difficult to detect in the dense woodland habitat (Pulich 1976). Three to five eggs are generally incubated in April, and unless there is a second nesting attempt, nestlings fledge in May to early June (Pulich 1976). If there is a second nesting attempt, it is typically in mid-May with nestlings fledging in late June to early July (Pulich 1976). By late July, GCWA begin their migration southward to their wintering habitat (Chapman 1907, Simmons 1924). Golden-cheeked warblers winter in the highland pine-oak woodlands of southern Mexico and northern Central America (Kroll 1980).

Historic and Current Distribution

The GCWA's entire breeding range occurs on the Edwards Plateau and Lampasas Cut Plain of central Texas. Golden-cheeked warblers have been confirmed breeding in 27 counties: Bandera, Bell, Bexar, Blanco, Bosque, Burnet, Comal, Coryell, Edwards, Gillespie, Hays, Johnson, Kendall, Kerr, Kimble, Kinney, Lampasas, Llano, Medina, Palo Pinto, Real, San Saba, Somervell, Travis, Uvalde, Williamson, and Young (Pulich 1976, Oberholser 1974). Golden-cheeked warblers have been sighted in the following 9 counties: Dallas, Eastland, Erath, Hamilton, Hill, Hood, Jack, McLennan, and Stephens (Pulich 1976, Edwards and Lewis 2008). Diamond (2007) estimated that the amount of suitable GCWA habitat across the species' range was about 4.2 million acres. The most recent estimate available is Duarte et al. (2013), who estimated that golden-cheeked warbler range-wide breeding habitat was about 3.9 million acres for the period of 2010-2011 and that breeding habitat for the period of 1999-2001 was about 5.48 million acres, indicating a decrease in about 1.58 million acres over 10 years. In addition to this reduction, they found the GCWA breeding habitat became more fragmented. The population status for the golden-cheeked warbler on private lands, where most of its habitat occurs, remains undocumented throughout major portions of the breeding range.

Reasons for Decline and Threats to Survival

Before 1990, the primary reason for golden-cheeked warbler habitat loss was juniper clearing to improve conditions for livestock grazing. Since then, habitat loss has occurred as suburban developments spread into golden-cheeked warbler habitat. Groce et al. (2010) summarized the rates of expected human population growth within the range of the golden-cheeked warbler and

found by 2030 the growth rate ranges from 17 percent around the Dallas-Fort Worth area to over 164 percent around San Antonio. As the human population continues to increase, so do associated roads, single and multi-family residences, and infrastructure, resulting in continued habitat destruction, fragmentation, and increased edge effects (Groce et al. 2010).

Fragmentation is the reduction of large blocks of habitat into several smaller patches. While golden-cheeked warblers have been found to be reproductively successful in small patches of habitat (less than 50 acres), there is an increased likelihood of occupancy and abundance as patch size increases (Coldren 1998, Butcher et al. 2010, DeBoer and Diamond 2006). Increases in pairing and territory success are also correlated with increasing patch size (Arnold et al. 1996, Coldren 1998, Butcher et al. 2010). In addition, while some studies have suggested that small patches that occur close to larger patches are likely to be occupied by golden-cheeked warblers, the long-term survival and recovery of the GCWA is dependent on maintaining the larger patches (Coldren 1998, Peterson 2001, The Nature Conservancy 2002).

As golden-cheeked warbler habitat fragmentation increases the amount of GCWA habitat edge, where two or more different vegetation types meet, also increases. For the GCWA, a habitat edge is where woodland becomes shrubland, grassland, a subdivision, or other land use type, and depending on the type of edge, it can act as a barrier for dispersal; act as a territory boundary; favor certain predators; increase nest predation; and/or reduce reproductive output (Johnston 2006, Arnold et al. 1996). Canopy breaks (the distance from the top of one tree to another) as little as 36 feet have been shown to be barriers to GCWA movement (Coldren 1998). Territory boundaries have not only been shown to stop at edges, but GCWA are more often farther from habitat edges (Beardmore 1994, DeBoer and Diamond 2006, Sperry 2007).

Other threats to GCWAs include the clearing of deciduous oaks upon which the GCWA forage, oak wilt infection in trees, nest parasitism by brown headed cowbirds (Engels and Sexton 1994), drought, fire, stress associated with migration, competition with other avian species, and particularly, loss of habitat from urbanization (Ladd and Gass 1999). Human activities have contributed to GCWA habitat loss throughout their range, particularly areas associated with the Interstate 35 corridor between the Austin and San Antonio metropolitan areas.

Rangewide Survival and Recovery Needs

The recovery strategy outlined in the Golden-cheeked Warbler Recovery Plan (Service 1992) divides the breeding range of the GCWA into eight regions, or units, and calls for the protection of sufficient habitat to support at least one self-sustaining population in each unit. Based on the Golden-cheeked Warbler Recovery Plan (Service 1992), protection and management of occupied habitat and minimization of degradation, development, or environmental modification of unoccupied habitat necessary for buffering nesting habitat are necessary to provide for the survival of the species. Habitat protection must include elements of both breeding and non-breeding habitat (i.e., associated uplands and migration corridors). Current and future efforts to create new and protect existing habitat will enhance the GCWA's ability to expand in distribution and numbers. Efforts, such as land acquisition and conservation easements, to protect existing viable populations are critical to the survival and recovery of this species, particularly when rapidly expanding urbanization continues to result in the loss of breeding habitat.

According to the Golden-cheeked Warbler Population and Habitat Viability Assessment Report (Service 1996) a viable population needs to consist of at least 3,000 breeding pairs. This and other population viability assessments on GCWA have indicated the most sensitive factors affecting their continued existence are population size per patch, fecundity (productivity or number of young per adult), and fledgling survival (Service 1996, Alldredge et al. 2002). These assessments estimated one viable population will need a minimum of 32,500 acres of prime unfragmented habitat to reduce the possibility of extinction of that population to less than five percent over 100 years (Service 1996). Further, this estimate of the minimum number of breeding pairs increases in poorer quality habitat (e.g., patchy habitat resulting from fragmentation).

Several state and federally owned lands occur within the breeding range of the GCWA, but the majority of the species' breeding range occurs on private lands that have been either occasionally or never surveyed. Currently there are five large GCWA populations receiving some degree of protection: those at the Balcones Canyonlands Preserve in Travis County; the nearby Balcones Canyonlands National Wildlife Refuge in Travis, Burnet, and Williamson counties; Camp Bullis and Texas Parks and Wildlife Department's Government Canyon State Natural Area in Bexar County; and the Fort Hood Military Reservation in Coryell and Bell counties. There are also several conservation banks (CB) that protect GCWA habitat (acreages represent the total if all bank credits are sold): Hickory Pass CB (3,003 acres) in Burnet County, Bandera Corridor CB (6,946 acres) in Bandera and Real counties, Clearwater CB (21,305 acres) in Burnet County, and Festina Lente CB (1,147 acres) in Bandera County.

Black-capped Vireo (*Vireo atricapilla*)

For more specific information regarding the BCVI, please refer to the Species Status Assessment Report for the Black-capped Vireo (*Vireo atricapilla*) (Service 2016) and Endangered and Threatened Wildlife and Plants; Removing the Black-Capped Vireo from the Federal List of Endangered and Threatened Wildlife (81 FR 90762) available at <https://www.fws.gov/southwest/es/arlingtontexas/bcvi.htm>.

Species Description and Life History

The BCVI was federally listed as endangered on October 6, 1987 (52 FR 37420-37423). No critical habitat was designated for this species. On December 15, 2016 the Service proposed to remove the BCVI from the list Endangered and Threatened Wildlife due to recovery (81 FR 90762). The BCVI is a 4.5-inch long, insectivorous songbird. Mature males are olive green above and white below with faint greenish-yellow flanks. The crown and upper half of the head are black with a conspicuous white eye-ring. The iris is brownish-red and the bill is black. Mature females are generally duller in color than males, and have a dark slate gray head (Service 2016).

Although BCVI habitat throughout Texas is quite variable with respect to plant species, soils, and rainfall, habitat types generally have a similar overall appearance. The BCVI typically inhabits shrublands and open woodlands with a distinctive patchy structure. The shrub vegetation generally extends from the ground to about 10 feet above ground and covers about 30 to 60 percent of the total area. In the Edwards Plateau, common plants in BCVI habitat include Texas oak (*Quercus texana*), shin oak (*Q. sinuata*), live oak (*Q. virginiana* & *Q. fusiformis*), mountain laurel (*Sophora secundiflora*), sumac (*Rhus*. sp), redbud (*Cercis canadensis* var. *texana*), Texas persimmon (*Diospyros texana*), mesquite (*Prosopis glandulosa*), and agarita

(*Mahonia trifoliata*). In the Edwards Plateau, suitable habitat for the BCVI is early successional scrub/shrub created by fire or woodland clearing. BCVI are opportunistic foragers; however, they prefer insect larvae and seeds (Grzybowski 1995).

Male BCVI arrive in central Texas in late March and begin to establish breeding territories, which they defend against other males by singing. Females arrive a few days later, but are more difficult to detect in the dense brushy habitat. Three to four eggs are generally incubated in April, and unless there is a second nesting attempt, nestlings fledge in May to early June. By mid-September, BCVIs have generally migrated south, beginning with females and young and followed by adult males (Graber 1957, Oberholser 1974). The BCVI breeds from Oklahoma south through central Texas to the Edwards Plateau, then south and west to central Coahuila, Nuevo Leon, and southwestern Tamaulipas, Mexico and they winter on the Pacific slope of Mexico.

Historical and Current Distribution

The historical breeding distribution of the BCVI included an area stretching from Kansas southward through central Oklahoma and through west-central Texas, with a southern limit in central Coahuila, Mexico. In 1987, the known breeding population was distributed across 21 counties in Texas, four counties in Oklahoma and in Coahuila, Mexico. From 1990 to 1996, the vireo was confirmed present in three Oklahoma counties and 40 Texas counties. From 2000 to 2005, Wilkins *et al.* (2006) confirmed vireo records from three Oklahoma counties and 38 Texas counties. It was suggested that the vireo no longer occurs in Kansas (Wilkins *et al.* 2006). From 2009 to 2014, the vireo has been confirmed in five Oklahoma counties and 40 counties in Texas (Service 2016). Prior to 2003, the BCVI's southern-most confirmed breeding range was in central Coahuila, Mexico (Wilkins *et al.* 2006). Since then, confirmed breeding has been documented in Nuevo León and Tamaulipas, extending the known breeding range 520 km (323 mi) southeast from the previous southernmost record near Ocampo, Coahuila (González-Rojas *et al.* 2014).

According to survey data from 2009 to 2014, approximately 40% of the known population in the breeding range occurred on four well-surveyed areas: Fort Hood Military Reservation (Texas), Kerr Wildlife Management Area (Texas), Wichita Mountains Wildlife Refuge (Oklahoma), and Fort Sill Military Reservation (Oklahoma) (Service 2016). Together, these facilities cover approximately 400,000 acres, an area representing only one percent of the total area of rangeland in the Texas/Oklahoma range of the species (Wilkins *et al.* 2006).

The current BCVI breeding range no longer appears to extend northward past central Oklahoma, and the species has not been documented in Kansas since the 1950s. The current U.S. breeding range documented from 2009 to 2014 includes five counties in Oklahoma and 40 counties in Texas (Service 2016). The discovery of breeding populations of the BCVI in southern Coahuila, Nuevo Leon, and Tamaulipas significantly extends their breeding range farther south than was known at the time of listing.

Reasons for Decline and Threats to Survival

At the time of listing, the identified major threats to the BCVI included habitat loss through land use conversion, grazing and browsing by domestic and wild herbivores, and brood parasitism by brown-headed cowbirds. The threat of vegetative succession, originally considered minor, appears to have been underestimated at the time of listing, although the extent of the effects on

the BCVI is not fully known. Historically, naturally occurring wildfires probably maintained a mosaic of suitable habitat throughout the BCVI's range. The threat of predation, also originally considered minor, appears to be of more importance than originally anticipated. Depredation rates of monitored nests at Fort Hood rose steadily between 1997 and 2005 then stabilized slightly above 50% afterward (Cimprich and Comolli 2009). At Fort Hood, brown-headed cowbird removal shows a strong negative correlation with overall parasitism rate. In 2010, Fort Hood had an overall parasitism rate of approximately 12%, up from a low of two percent in 2003 (Cimprich and Comolli 2010). Following the cessation of cowbird trapping on the west range of Fort Hood in 2006, parasitism has increased by more than four times the original rate (Cimprich and Comolli 2009), but then decreased to less than three times the original rate in 2010 (Cimprich and Comolli 2010). During this same time, parasitism on the east range, where trapping still occurs, has remained stable. On average, cattle densities throughout the BCVI's U.S range have shown moderate decreases since 1997; average goat densities throughout the BCVI's Texas range have been steadily decreasing since the BCVI was listed in 1987 (Service 2016).

Range-wide Survival and Recovery Needs

The Black-capped Vireo Recovery Plan (Service 1991) provides preliminary criteria that would meet the interim objective of downlisting the species to threatened status. One of these criteria requires at least one viable BCVI population in each of four Texas regions and one each in Oklahoma and Mexico (Service 1991). The Service's 5-year status review of the BCVI found the Recovery Plan to be in need of revision and recommended the species be downlisted to threatened status (Service 2007). On December 15, 2016, the Service proposed to remove the BCVI from the list of Endangered and Threatened Wildlife due to recovery (81 FR 90762) and published a supporting Species Status Assessment for the BCVI (Service 2016).

Continued vegetation and cowbird management within known populations is needed for persistence in portions of the species' breeding range. There are 40 BCVI populations under some form of management in Oklahoma and Texas, varying in size from a single adult male to an estimated 7,478 adult males. Of these, 9 are considered likely resilient populations and another 10 are considered manageable populations. The proposal recommends the continuation of brown-headed cowbird trapping on Federal and private properties and the expansion of this practice to other properties to improve BCVI breeding success.

III. Environmental Baseline

Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all federal, state, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated and/or ongoing impacts of all proposed federal projects in the action area that have undergone section 7 consultation, and the impacts of state and private actions which are contemporaneous with the consultation in progress.

The action area is approximately 558 acres just south of and adjacent to the Four Points area of Travis County, Texas, on an upland ridge within the heavily dissected topography of the Jollyville Plateau, which forms the southern tip of the Northern Segment of the Edwards Aquifer (see Figure 1-5 in the BA). The project area and surrounding region is located within karst terrain and local runoff provides recharge through karst features to this portion of the Edwards

Aquifer. Since the Northern Segment of the Edwards Aquifer is not a significant source of drinking water, the State of Texas' Edwards Aquifer Rules do not apply. However, the karst features and associated springs in the Jollyville Plateau region support habitat for numerous rare species and recharge of high quality water is required to sustain these important ecosystems. Land use is primarily dispersed urban development including roads, commercial and retail businesses, schools, and residential development.

Endangered Karst Invertebrates

Areas of karst terrain are subdivided into four categories that describe the probability that the subterranean karst environment may contain endangered karst invertebrates. Zone 1 are areas known to contain endangered cave fauna, zone 2 are areas having a high probability of suitable habitat for endangered invertebrate cave fauna, zone 3 are areas that probably do not contain endangered cave fauna, and zone 4 are areas which do not contain endangered cave fauna. This project is located almost entirely in karst zone 1. Approximately 533 acres of the action area are within karst zone 1, while the remaining 25 acres of the action area are in karst zone 3.

Six caves where endangered karst invertebrates have been found were already known within the action area of this project (identified in Figure 2-5 and Table 2-3 of the BA). Four of the species considered in this biological opinion have been documented in one or more of these six caves: Tooth Cave spider, Tooth Cave harvestman, Tooth Cave ground beetle, and Bee Creek Cave harvestman. One or more of these caves may also contain other species, as discussed earlier in the status of the species discussion. The cave cricket foraging area of one of these caves is within project area (within 344 feet from the cave entrance).

During TXDOT's initial geologic field investigations, prior to the landowner withdrawing permission, 43 additional karst features were documented (Table 2-2 in the BA). TXDOT has not conducted presence absence surveys according to the Service's survey protocol (Service 2015); therefore, TXDOT cannot exclude the possibility that one or more of the additional features contains one or more of the endangered karst invertebrates. Nine karst features are documented in the footprint of the new bypass.

The Service has analyzed the effects of federal actions on these species in Travis and Williamson counties since the early 1990's. Most of these section 7 consultations were for projects occurring in Williamson County and most were either road or pipeline projects where the karst invertebrate impacts could not be determined. Two consultations for karst species have been completed within the Jollyville Plateau KFR. The section 7 consultation for Canyon Creek development (21450-93-F-0075) allowed impacts to 359 acres and established a permanent preserve around Stovepipe Cave and a 150 foot setback from Lamm Cave. The other is the section 7 consultation for creating fuel breaks to prevent wildland fires on 36 segments of the Balcones Canyonlands Preserve (02ETAU00-2015-F-0097) that authorized impacting up to nine karst features. Three habitat conservation plans (HCPs) would result in the following amount of take and preserve establishment for karst species at full implementation:

1. Balcones Canyonlands HCP (Service Permit PRT-788841) authorized the loss of 38,349 acres of potential karst habitat and to date has preserved 59 karst features within the Jollyville Plateau, McNeil/ Round Rock, Cedar Park, and the Central Austin KFRs;

2. Four Points HCP (Service Permit PRT-808694) authorized destruction of one cave (Puzzle Pit) and impacts to the drainage area of another cave (Twisted Elm) and preserved five endangered species caves; and,
3. GDF HCP (Service Permit TE-171255) authorized impacts to approximately 29 acres of karst habitat and preserved approximately 30 acres of karst habitat with an additional payment to BCCP.

Black-capped Vireo

There are six recovery units for the black-capped vireo within Texas. The majority of Travis County is within recovery unit 2 with a small portion within recovery unit 3 per the Service's 1991 recovery plan. TXDOT assessed the action area for black-capped vireo habitat in February 2016 and January 2017 and delineated approximately 24 acres of habitat. Of this habitat acreage, approximately 2 acres are within the project footprint and the remainder is in the action area, but outside the project area.

Four previous section 7 consultations that include take of black-capped vireos have been completed for actions within Travis County resulting in the loss of approximately 77 acres and the preservation of approximately 200 acres of black-capped vireo habitat.

Only one HCP that includes take of black-capped vireo has been completed for actions within Travis County:

1. The Balcones Canyonlands conservation plan (PRT-788841) authorized removal of 1,000 acres of black-capped vireo habitat. The plan calls for a minimum of 2,000 acres of endangered species habitat in western Travis County to be set aside and managed within the BCP.

Golden-cheeked Warbler

There are eight recovery units for the golden-cheeked warbler within Texas. Travis County is within recovery unit 5 per the Service's 1992 recovery plan. TXDOT assessed the action area for golden-cheeked warbler habitat in February and March 2016 and delineated approximately 151 acres of habitat. Of this habitat acreage, approximately 4 acres are within the project footprint and the remainder is in the action area. Breeding bird surveys were not conducted by TXDOT; however, golden-cheeked warblers have been documented within the project footprint and action area.

There have been 12 formal section 7 consultations that include take of golden-cheeked warblers within Travis County resulting in the loss of approximately 2270 acres and the preservation of approximately 2335 acres of golden-cheeked warbler habitat.

Nineteen HCPs covering the golden-cheeked warbler have been issued that, at full implementation, would result in over 22,500 acres of take and result in over 12,600 acres of preserve and over \$290,000 to the Balcones Canyonlands Conservation Plan.

TXDOT assessed the action area for golden-cheeked warbler habitat and estimated approximately 151 acres habitat, of which approximately 4 acres is within will be removed for the construction of the bypass and for road widening. Breeding bird surveys were not conducted by TXDOT, however, golden-cheeked warblers are known to be present in areas nearby the project action area. The City of Austin and Travis County own and manage tracts of land for the protection of endangered species in the vicinity of the project.

IV. Effects of the Action

Karst Invertebrates

TXDOT was denied access by the landowner of the future bypass right-of-way to fully assess all potential karst features for the presence of endangered karst invertebrates. As a consequence of this situation there is a lack of data related to the occupancy by listed species of features in the action area. For the purposes of this consultation, TXDOT used the data it collected during a period of time when access was granted. They supplemented that data with other available data to inform the biological assessment. TXDOT has identified nine features that would be under the new bypass or in its right-of-way, including one that TXDOT determined is not suitable karst invertebrate habitat. The surface and subsurface drainage basins for these features have not been delineated. Once TXDOT has access to the property, they will assess these features further for habitat suitability and occupancy. Table 2.2 of the BA lists the features known to occur in the action area.

The known occupied caves in the action area are Geode Cave, Steiner Ranch Cave, New Comanche Trail Cave, Twisted Elm Cave, and Puzzle Pits Cave (BA Table 2-3). In addition, Spider Cave and Tooth Cave are in close proximity to the action area. Figures 2-5 and 2-6 in the BA show the locations of the features and occupied sites in the action area.

The proposed action would occur entirely in the Jollyville Karst Fauna Region in Travis County and almost entirely in areas delineated as karst zone 1, which is an area of karst terrain with a high potential to be occupied by endangered karst invertebrates. The action area consists of a small portion of the Jollyville KFR, about eight percent. The construction footprint and cleared right-of-way would also affect an unknown amount of subsurface karst habitat and mesocaverns within the action area. The direct effects would be localized in the project area with indirect effects extending 500 feet beyond the construction footprint. The majority of the construction area is already developed. It is mostly existing road pavement, residential and commercial development, or vegetated right-of-way. The effects of the new bypass construction will have new impacts to karst features and loss of habitat.

Construction related to utility relocations is scheduled to begin as early as April 2018. Construction for the roadway project is scheduled to begin in January of 2019 and roadway construction is expected to continue for approximately two years. Operation and maintenance of the proposed action will be ongoing into the future. Karst invertebrates are small and slow moving species that are not known to move from one area to another to avoid or escape from disturbance. During the two-year construction period, karst species present in the action area may be crushed by heavy equipment during excavation and trenching. This exposure is limited to those individuals that will be present in the areas impacted by construction. Karst features that are exposed during construction will be closed quickly to maintain environmental conditions inside the voids. The indirect effects include loss or degradation of habitat and changes to the

movement patterns of cave crickets. The ongoing operation and maintenance includes ensuring the water quality BMPs continually function as intended to minimize water quality impacts.

The effects associated with highway construction activities would directly alter the karst habitat within the action area where features occur. If new karst voids are encountered during construction they will also be degraded. However, the project would not affect the overall population size, variability, or distribution outside of the action area. The project has been designed to minimize effects that would occur within the action area on endangered karst invertebrates. If any new karst features are found during construction, TXDOT would investigate the features to determine if karst invertebrate habitat exists in those features. If possible, impacts to newly discovered features would be avoided or minimized and the features would be closed in a manner that maintains some level of functionality, if appropriate and based on consultation with a Service-permitted karst biologist.

The proposed action consists of the new bypass road, improvements to RM 2222 and improvements to RM 620 which are separate, but related, project elements. Aspects of each element will likely occur concurrently during the two-year project construction period. Any vegetation within the right-of-way would be removed completely at the onset of construction and the disturbance would continue throughout construction of the project. Any previously undiscovered karst invertebrate habitat located in the right-of-way prior to the start of construction would be likely be impacted; however, the direct effects to the karst invertebrates would be limited to activities that require excavation of subsurface habitat, and those would only occur if the karst feature is directly disturbed by surface excavation activities. Portions of existing roadway would be removed during construction in areas that were previously disturbed and would not likely result in direct effects to karst invertebrate habitat.

Indirect effects are possible within the action area during and after construction and may last for as long as the road is in use. These effects include changes to surface and subsurface drainage basins within the action area, alteration of flows, water contamination, nutrient inputs from road runoff, and chemical spills. Clearing vegetation can affect endangered karst invertebrates by altering the surface ecology including habitat for troglophiles that obligate cave species rely on for nutrients. Surface vegetation loss, land use changes and disturbance can also lead to the introduction of invasive species into the area such as red-imported fire ants, which negatively impact the habitat. Because it is not currently known if any of the 9 known karst features in the bypass alignment or any of the other approximately 52 features in the action area with habitat characteristics are occupied, it cannot be determined if individual karst invertebrates will be affected. If one or more of these features are occupied, the individuals inhabiting the karst environment in that area may be affected due to a reduced number of cave crickets supported by the surface vegetation. Fragmentation of the cave cricket foraging area will also limit the ability of cave crickets to enter karst features. Fewer cave crickets entering and exiting the karst features will reduce the amount of nutrients carried into the subterranean habitat. Some of the impacts of vegetation clearing will be minimized by revegetating disturbed areas with native seeds and plants to restore plant communities to the extent possible to continue to support cave cricket foraging. The fragmentation of the cave cricket foraging area will be a permanent impact.

The addition of 0.4 miles of road will change the hydrology of the area to the extent that water that currently enters the karst ecosystem in the alignment of the proposed bypass will be diverted

into drainage structures. The changes in surface and subsurface drainage basins have the potential to decrease and change the quantity of the water and thus humidity in the karst species habitat. A reduction in humidity levels will negatively impact the individuals of these species making the habitat less suitable or potentially unusable by the listed species. These effects will occur both during construction and continue after the project is completed because of the permanent change from open ground to impervious road surface and structures if voids slowly desiccate over time. The bypass includes three drainage culverts. Two of the three culverts have been designed to span existing karst features to minimize impacts from the proposed action by allowing the features to remain open to drainage flows and to the movement of cave crickets.

The proposed action includes the construction of a new section of road where there is currently vacant land. The placement of pavement will prevent moisture from directly infiltrating into the subterranean environment and may lower the humidity of the karst invertebrate habitat. TXDOT has included BMPs to limit contamination.

The construction of the bypass includes excavation, bore holes, surface milling, and grading below the current ground surface. The BA includes a detailed description of different methods of removing material to install roadway and associated structures and buried sewer and electrical lines. The effect of removing the existing limestone at and below the surface is the loss of karst habitat where it is present. TXDOT will add fill material to the surface for some portions of the bypass to reduce the amount of excavation required. The bypass will require approximately 2,100 cubic yards of excavated material in two sections of the bypass and for each of the three culverts. Where excavation for the bypass will occur it could be as much as 3 feet deep.

Karst habitat is irreplaceable. Excavation into the karst will permanently alter habitat by breaking up the rock formations and by adding other materials and fill into and on top of the excavated areas. In addition, where there are fissures and mesocaverns intersecting with excavated project areas, these connecting passages may be disconnected or altered. Any prior use by individuals may become limited or no longer be possible.

The widening and improvements to RM 2222 include excavation along the entire length of RM 2222 for expanding the road and trenching to relocate utility lines. Reconstructing the existing road may have construction related impacts while widening the existing road will increase the amount of impervious cover which will have impacts on karst habitat. RM 2222 in the project area is a developed corridor that has been previously disturbed. Nevertheless, changes in water quantity and quality may have negative impacts on karst invertebrate habitat although the use of BMPs may lessen those impacts.

Black-capped Vireo and Golden-cheeked warbler

Suitable breeding habitat for endangered black-capped vireo and golden-cheeked warblers is located in the action area and will be permanently cleared for the proposed action. The project is near lands that have been permanently protected for these species: Cortana, Lucas Tract, and Four Points. Approximately 24 acres of black-capped vireo and approximately 151 acres of golden-cheeked warbler habitat occurs in the action area.

Neither golden-cheeked warblers nor black-capped vireo individuals will be directly affected by the proposed action because habitat clearing will be conducted when the birds are in their wintering habitat in southern Mexico and Central America. The direct effects will be the loss of

2 acres and 4 acres of breeding habitat in the action area for black-capped vireos and golden-cheeked warblers, respectively. The indirect effects of construction include the degradation 22 acres of black-capped vireo and 147 acres of golden-cheeked warbler habitat. The habitat for these species will be destroyed through clearing or degraded due to fragmentation.

Fragmentation of habitat introduces new edges to habitat patches and increases the probability of predation. The bypass will permanently separate habitat patches on the north side of the road from the larger southern patch, likely eliminating usage of the northern portion of habitat by reducing the usable size to less than sufficient to support feeding and breeding activities. TXDOT has not conducted surveys to determine if individuals have been using these habitat areas during the breeding season. However, previous survey data has documented their presence.

Beneficial effects

All of the conservation measures proposed by TXDOT for this project would benefit these species to some degree. The contribution of funding to the BCCP will directly benefit listed karst invertebrates, the golden-cheeked warbler, and black-capped vireo by contributing to the ongoing management of known occupied sites and habitat for all eight species potentially impacted by the proposed action as well as acquisition.

The BCCP currently protects and manages habitat for all eight species covered in this biological opinion on over 31,000 acres of land in western Travis County. Funds from TXDOT will contribute to the BCCP surveys and monitoring of karst features for listed species and for limiting the effects of invasive species such as red-imported fire ants and tawny crazy ants, which are both a concern for longevity of the karst invertebrates. The BCCP treats ant mounds it finds near protected caves and monitors and responds to instances of trespassing and other signs of vandalism and incompatible uses or illegal entry on to their property.

The BCCP protects and manages GCWA and BCVI habitat. Funds from TXDOT could be used to continue managing and improving habitat for these species or to purchase new preserves. The BCCP's efforts are significantly contributing to the recovery of the species through the preservation and management of habitat necessary to meet the recovery criteria for each of the species affected by the project.

V. Cumulative Effects

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

There are no known future state, tribal, local, or private actions in the action area; however, because of the growth in Travis County there may be effects to listed species resulting from future development. In particular, commercial or residential development adjacent to the new bypass is likely to occur. The action area is within the area covered by the BCCP and future non-federal actions could obtain incidental take coverage through the BCCP or apply for a separate section 10(a)(1)(B) permit from the Service.

VI. Jeopardy and Adverse Modification Analysis

Section 7(a)(2) of the ESA requires that federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. No critical habitat was designated for the species adversely affected by the proposed action; therefore, this biological opinion will not analyze adverse modification of critical habitat.

Jeopardy Analysis Framework

“Jeopardize the continued existence of” means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). The following analysis relies on four components: (1) Status of the Species, (2) Environmental Baseline, (3) Effects of the Action, and (4) Cumulative Effects. The jeopardy analysis in this Opinion emphasizes the range-wide survival and recovery needs of the species and the role of the action area in providing for those needs. It is within this context that we evaluate the significance of the proposed federal action, taken together with the cumulative effects, for purpose of making the jeopardy determination.

Analysis for Jeopardy

Individual black-capped vireos and golden-cheeked warblers will not be affected because the clearing of habitat will be timed to occur when the birds have migrated to the southern wintering habitat. The losses of breeding habitat for each of these species is small compared to the amount that exists and which are protected in both Travis and neighboring Williamson County; therefore, we do not expect a significant negative impact on either of these species’ populations.

Individual Bee Creek harvestman may be affected by the proposed action, as discussed above in the Effects of the Action. This species occurs in two KFRs. Within the Jollyville KFR there are two potential recovery quality KFA indicating that the species has some resilient locations within the KFR. However, one additional KFA is necessary to meet recovery (Service 1994).

Individual Bone Cave harvestman maybe affected by the proposed action as discussed above in the Effects of the Action. This species occurs in six KFRs. Within the Jollyville KFR there are eight potential recovery quality KFAs indicating that the species has some resilient locations within the KFR and can meet the recovery criteria (Service 1994).

Individual Tooth Cave psuedoscorpions may be affected by the proposed action, as discussed above in the Effects of the Action. This species occurs in one KFR. Within the Jollyville KFR there are at least three potential recovery quality KFAs indicating that the species has some resilient locations within the KFR and can meet the recovery criteria (Service 1994).

Individual Tooth Cave spiders may be affected by the proposed action, as discussed above in the Effects of the Action. This species occurs in two KFRs. Within the Jollyville KFR there are seven potential recovery quality KFAs indicating that the species has some resilient locations within the KFR and can meet the recovery criteria (Service 1994).

Individual Kretschmarr Cave mold beetles may be affected by the proposed action, as discussed above in the Effects of the Action. This species occurs in two KFRs. Within the Jollyville KFR

there two potential recovery quality KFAs indicating that the species has some resilient locations within the KFR. However, one additional KFA is necessary to meet recovery (Service 1994). Individual Tooth Cave ground beetles may be affected by the proposed action, as discussed above in the Effects of the Action. This species occurs in two KFRs. Within the Jollyville KFR there are eight potential recovery quality KFAs indicating that the species has some resilient locations within the KFR and can meet the recovery criteria (Service 1994).

In addition to the known features, there exists the potential for listed species to be present in subsurface spaces lacking obvious surface expressions to be destroyed or significantly disturbed by construction activities. These voids are generally unanticipated because they have no significant openings to the surface, and for this reason they generally lack the input of moisture and nutrients essential for the support of karst invertebrates. Previously undetected voids discovered during construction activities rarely contain listed species. For example, the Buttercup Creek Subdivision in Williamson County, Texas found no additional listed invertebrates in any features found during development of the 438 acre parcel (as noted in the annual reports submitted for the Buttercup HCP PRT836384). Another example is construction of State Highway 45 where nine additional caves were discovered during construction; however, only two of them contained listed karst invertebrates (consultation number 1998-F-0205). While it is reasonably probable that take may occur when undetected yet occupied karst habitat is impacted by the proposed action, TXDOT will conduct karst surveys in accordance with the Service's protocols prior to construction to minimize the likelihood that occupied karst habitat will be impacted.

Irrespective of the extent to which undiscovered features are impacted by the proposed project, these features do not contribute to the environmental baseline for the species, since their presence and extent are undeterminable. At the time of their discovery, any occupied features are simultaneously increasing the known distribution of a species and significantly degrading or destroying them. Furthermore, an occupied feature discovered during construction could, at most, be defined as a low quality KFA, thereby not contributing to recovery, because the impacts from typical construction methods will have one or more of the following consequences: total loss of the feature, alteration of the surface or sub-surface drainage basin, loss or reduction of the cave cricket foraging area, or loss of the supporting vegetation (Service 2011).

Conclusion

We considered the current overall status of the black-capped vireo, golden-cheeked warbler, Tooth Cave spider, Tooth Cave ground beetle, Tooth Cave pseudoscorpion, Bee Creek Cave harvestman, Kretschmarr Cave mold beetle, and the Bone Cave harvestman and the condition of the species within the action area. We then assessed the effects of the proposed action and the potential for cumulative effects in the action area on individuals, populations, and the species as a whole. These types of effects of the proposed action are currently considered factors influencing the status of the species. While they may compound those factors, as stated above, we do not anticipate any reductions in the overall RND of these species. It is the Service's Opinion that the action, as proposed, is not likely to jeopardize the continued existence of these species.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulation pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, would, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further define by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns including feeding, breeding, and sheltering (50 CFR 17.3). Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3). Incidental take is defined as take that is incidental to, and the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by TXDOT so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in Section 7(o)(2) to apply. TXDOT has a continuing duty to regulate the activity covered by this incidental take statement. If TXDOT: (1) fails to assume and implement the terms and conditions, or (2) fails to adhere to the terms and conditions of the incidental take statement, the protective coverage of Section 7(a)(2) may lapse. To monitor the impact of incidental take, TXDOT must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.14(i)(3)].

The Service will not refer the incidental take of any migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703-712), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service anticipates incidental take of karst invertebrate species will be difficult to detect, since karst-dwelling invertebrates live entirely underground, and surface expressions of underground habitat may not be visible from the surface making detection difficult. However, the following level of take of this species can be anticipated by loss acres of karst zones 1 and 2 because these zones delineate the areas of highest probability that karst invertebrates could or do occupy the subterranean limestone formations.

The anticipated take is described in Table 1 below.

Species	Amount of Take Anticipated	Life Stage when Take is Anticipated	Type of Take	Take is Anticipated as a Result of
Black-capped vireo	24 acres	Individuals are not expected to be present when habitat cleared. Individuals of any life stage may be affected by degraded habitat.	Harm	Loss and degradation of suitable breeding habitat
Golden-cheeked warbler	151 acres	Individuals are not expected to be present when habitat cleared.	Harm	Loss and degradation of suitable breeding habitat

		Individuals of any life stage may be affected by degraded habitat.		
Tooth Cave pseudoscorpion	533 acres of karst zone 1	Juvenile, adult	Harm, harass	Injury or death by crushing during construction, Loss or degradation of karst habitat
Tooth Cave spider	533 acres of karst zone 1	Juvenile, adult	Harm, harass	Injury or death by crushing during construction, Loss or degradation of karst habitat
Tooth Cave ground beetle	533 acres of karst zone 1	Juvenile, adult	Harm, harass	Injury or death by crushing during construction, Loss or degradation of karst habitat
Bone Cave harvestman	533 acres of karst zone 1	Juvenile, adult	Harm, harass	Injury or death by crushing during construction, Loss or degradation of karst habitat
Kretschmarr Cave mold beetle	533 acres of karst zone 1	Juvenile, adult	Harm, harass	Injury or death by crushing during construction, Loss or degradation of karst habitat
Bee Creek Cave harvestman	533 acres of karst zone 1	Juvenile, adult	Harm, harass	Injury or death by crushing during construction, Loss or degradation of karst habitat

Effect of the Take

In the accompanying biological opinion, the Service has determined that this level of anticipated take is not likely to result in jeopardy to the Tooth Cave pseudoscorpion, Tooth Cave spider, Tooth Cave ground beetle, Bee Creek Cave harvestman, Bone Cave harvestman, Kretschmarr Cave mold beetle, black-capped vireo, or the golden-cheeked warbler. The best management practices and conservation measures included in the proposed action will minimize the adverse effects on these species and the contribution to the recovery of these species via partnership with the Balcones Canyonlands Conservation Plan will have long-term benefits on the conservation and recovery of these species.

REASONABLE AND PRUDENT MEASURES

The Service believes that the following reasonable and prudent measure is necessary and appropriate to minimize take of endangered karst invertebrates, golden-cheeked warbler and black-capped vireo.

1. TXDOT shall minimize harassment and harm of Tooth Cave pseudoscorpions, Tooth Cave spiders, Tooth Cave ground beetles, Kretschmarr Cave mold beetles, Bee Creek Cave harvestman, Bone Cave harvestman, black-capped vireos, and golden-cheeked

warblers during activities associated with the RM620 and RM2222 Improvements and New Arterial project described in this biological opinion and TXDOT's biological assessment.

Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the ESA, TXDOT must comply with the following terms and conditions, which implement the reasonable and prudent measure described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

1. All personnel involved in any authorized covered activities covered by this biological opinion shall be informed of these terms and conditions prior to the implementation of the authorized activity. TXDOT must hold a pre-construction meeting with its employees and contractors working on this project. TXDOT must provide specific instruction on the implementation of TXDOT's Conservation Measures and the Service's Reasonable and Prudent Measures, included in this Incidental Take Statement. Instructions specific to the contractor(s) related to implementation of the Conservation Measures and Reasonable and Prudent Measures must be documented in writing. TXDOT is ultimately responsible for informing anyone working on this project of these requirements.
2. The clearing of golden-cheeked warbler and black-capped vireo habitat shall be conducted from September 1 through February 15 when individuals are not present.
3. TXDOT shall follow all avoidance, minimization, and conservation measures described in the biological assessments and TXDOT's subsequent revisions to the proposed action.
4. Prior to the start of construction activities, TXDOT will fund the BCCP in the amount \$190,655.00 to support the ongoing management of endangered species habitat under the management of the Balcones Canyonlands Preserve.
5. Prior to the completion of project construction, TXDOT will provide funding to the City of Austin up to \$200,000 for karst studies address recovery criteria for the listed karst invertebrate species and may include: excavation/restoration of BCP-protected caves in the vicinity of the action area, faunal surveys, mapping of surface/subsurface drainage areas of caves in this area, and hydrogeological studies of caves in this area.
6. All fill material would be inspected for tawny crazy-ants before being deployed to the project site.
7. A qualified scientist holding a 10(a)(1)(A) permit for karst invertebrates will be on-call

throughout the duration of the geotech and construction phase to investigate voids as follows:

When a previously unknown void is discovered during construction, all construction work in the area out to a minimum radius of 50 feet will cease. Distance of work stoppage may be more than 50 feet, as determined by TXDOT to account for safety issues.

Boreholes

During borehole activities, voids in bedrock are usually indicated by a bit drop or a decrease in drilling pressure. If a bit drop of more than 1 foot is detected while advancing a borehole or a decrease in drilling pressure indicates a void, then the geotechnical operator will cease operation and notify TXDOT. The borehole will be inspected by a permitted scientist for voids using a downhole camera. If the borehole contains no voids or voids that do not meet the criteria for potential habitat, then work at that bore will continue.

If the borehole contains voids that meet the criteria for potential karst invertebrate habitat, an area will be cordoned off and protected (area to be determined by TXDOT on the basis of safety and feature protection). All other work in the area immediately around the borehole will cease until it can be safely closed. Work stoppage in the vicinity of a borehole with potential habitat will be maintained during the period required for closure and the approvals of applicable protection plans. TXDOT will coordinate with appropriate regulatory agencies and provide instructions to the contractor on how to proceed. If a void encountered during borehole activities meets the criteria for potential karst invertebrate habitat, then the borehole will be closed and an alternative site selected. Typically, the borehole will be plugged above the void, leaving the void open for invertebrate habitat, and filled to the surface with grout or other suitable material.

Previously Unknown Voids Discovered During Excavation

Karst features encountered during other bedrock excavation activities will also be evaluated by TXDOT for the presence of karst invertebrate habitat and the potential biological significance of the void. Work stoppage will occur as outlined for features encountered during borehole activities. The feature will be evaluated for potential karst invertebrate habitat by a permitted scientist. If the feature meets the criteria for potential karst habitat, then it will be evaluated for its biological significance on a case-by-case basis. If the feature does not meet the criteria for potential karst habitat, then work will continue.

If a discovered feature is determined to be occupied or presumed occupied by a listed karst invertebrate, then TXDOT will proceed in such a manner as to minimize impacts to the feature. If it is possible within the needs of the project, then the feature

will be sealed. If work must continue at the feature, then disturbance to the feature will be minimized, but the details will be determined on a case-by-case basis following recommendations from a permitted scientist and an engineer. When features are closed, they will be closed in a condition as similar as possible to pre-excavation condition with regard to water and nutrient inflow and void volume, while protecting the feature from contaminated runoff.

If complete avoidance of occupied karst features encountered during construction is not possible, an evaluation will be performed of the extent that the feature may be impacted and TXDOT will include the loss as part of the authorized take. TXDOT will provide instructions to the contractor on how to proceed on a case-by-case basis at each occupied or presumed occupied void encountered.

If a potential karst void is encountered, work in the vicinity of the feature will cease until an evaluation is complete. TXDOT will utilize reconnaissance excavation and evaluation procedures outlined by Service protocols (Service 2015) to determine whether a karst habitat assessment is needed. If a karst habitat assessment is warranted, it will follow the same protocols and steps outlined above. While a feature is being evaluated, the surface expression will be covered in order to minimize the influence of diurnal variations in surface temperature. Protection of the feature may include a wood cover, plastic sheeting, and/or blanket that is weighted down with rocks around the perimeter. During periods of high temperatures ($>100^{\circ}$ F), a piece of insulation will be added to the cover. Hazard fencing or barricades may be used to protect the area if there is a fall hazard, such as the case of an open shaft. Appropriate BMPs will be implemented to prevent surface runoff from entering the feature.

Monitoring and Reporting Requirements

1. TXDOT shall provide monthly summary reports to document the number and location of voids encountered, at what depth, a summary of results of karst invertebrate surveys conducted, any observations made with a down-hole camera, a summary of the work actions completed during the reporting period, and what actions are anticipated in the next reporting period. These reports would be provided to the Service semi-annually during the construction phase.

CONSERVATION RECOMMENDATIONS

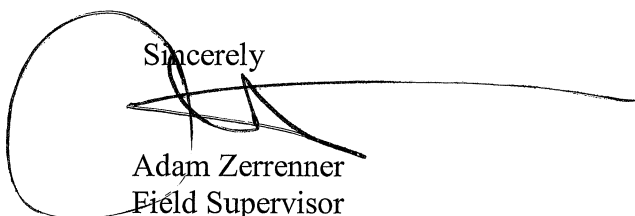
Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or develop information.

1. TXDOT should assist the Service in the implementation of the recovery plans for the Tooth Cave spider, Tooth Cave pseudoscorpion, Tooth Cave ground beetle, Bee Creek Cave harvestman, Bone Cave harvestman, and the Kretschmarr Cave mold beetle, golden-cheeked warbler, and the black-capped vireo.
2. In order for the Service to be kept informed of the actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, we request notification of implementation of this conservation recommendation.

Reinitiation Notice

This concludes formal consultation on the RM 620 and RM 2222 Improvement and New Arterial Connector project. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency or action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of take is exceeded, any operations causing such take must cease pending reinitiation.

If you any questions regarding this opinion, our response to your concurrence request, or our shared responsibilities under the ESA please contact Charlotte Kucera at 512-490-0057.

Sincerely

 Adam Zerrenner
 Field Supervisor

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